Transforming Diabetes Care

Advanced Carbohydrate Counting
Tools, Magic and Survival Skills

Paula Clinton, RD, CDE
Stanford University
Pediatric Endocrinology
What does it take to carbohydrate count?

- Knowledge of foods
- Basic math skills
- Ability to read a food label
- Time & patience
- Magic
- Survival skills
Where to start?

• Identify carbohydrate foods
• Review food labels
• Determine a “portion” vs. a “serving”
• Start counting carbohydrates (master the art of guessing!)
• Use insulin-to-carb ratios
• Fat and protein
• Fiber
• Sugar alcohols
• Glycemic index
Identify Carbohydrates
# Review Food Labels

## Nutrition Facts

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>½ cup (114g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servings Per Container</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Calories 90</th>
<th>Calories from Fat 30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Fat</strong></td>
<td>3g</td>
<td>5%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
<td>0mg</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td>300mg</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Total Carbohydrate</strong></td>
<td>13g</td>
<td>4%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>3g</td>
<td>12%</td>
</tr>
<tr>
<td>Sugars</td>
<td>3g</td>
<td></td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>3g</td>
<td></td>
</tr>
</tbody>
</table>

- Vitamin A 80%
- Vitamin C 60%
- Calcium 4%
- Iron 4%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your caloric needs.*

<table>
<thead>
<tr>
<th>Calories:</th>
<th>2,000</th>
<th>2,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>Less than 65g</td>
<td>80g</td>
</tr>
<tr>
<td>Sat Fat</td>
<td>Less than 20g</td>
<td>25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2,400mg</td>
<td>2,400mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>300g</td>
<td>375g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>25g</td>
<td>30g</td>
</tr>
</tbody>
</table>

Calories per gram:
- Fat 9 • Carbohydrate 4 • Protein 4
Serving vs. Portion

A **SERVING** = amount of food you see listed on the Nutrition Facts Food Label

Example: ½ cup pasta or 10 crackers or 1 granola bar

A **PORTION** = amount of food you choose to put on your plate and eat

Example: 1 ½ cups pasta or 20 crackers

The PORTION you put on your plate may actually contain several SERVINGS
There’s an app for that ...

Example of a phone application that provides visual representations of portion sizes with nutritional information. Adjust the portion sizes with a sliding bar.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories 134</td>
<td>Sodium 111mg</td>
<td>Calories 134</td>
<td>Sodium 111mg</td>
</tr>
<tr>
<td>Cals from Fat 7</td>
<td>Carbs 26g</td>
<td>Cals from Fat 7</td>
<td>Carbs 26g</td>
</tr>
<tr>
<td>Total Fat 1g</td>
<td>Fiber 2g</td>
<td>Total Fat 1g</td>
<td>Fiber 2g</td>
</tr>
<tr>
<td>Saturated Fat 0g</td>
<td>Sugars 0g</td>
<td>Saturated Fat 0g</td>
<td>Sugars 0g</td>
</tr>
<tr>
<td>Trans Fat 0g</td>
<td>Protein 5g</td>
<td>Trans Fat 0g</td>
<td>Protein 5g</td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>Alcohol 0g</td>
<td>Cholesterol 0mg</td>
<td>Alcohol 0g</td>
</tr>
</tbody>
</table>

Johnson & Johnson INSTITUTE
Carbohydrate Quantity vs. Quality

**Quantity:**
The carbohydrate quantity causes the rise in blood glucose after a meal and determines the bolus size.

**Quality:**
The carbohydrate quality effects the rate at which blood glucose rises and determines the type of bolus to be used.
Glycemic Response of Food Groups

Based on information from:

Basic Carbohydrate Counting

- Uses “Carb Choices” or “Exchanges” 1 exchange/choice = 15 grams of carb
- 1 fruit = 1 starch = 1 milk = 15 grams
- Non-starchy vegetables are free
- This system is based on averages and not precise
- OR count “exact” grams of carbohydrate in a food item

1/3 cup = rice
Advanced Carbohydrate Counting

• This is the amount of insulin to cover the carbohydrate eaten at a meal or snack

• Goal is to match rapid acting insulin dose to carbohydrate amount

• 1 unit of insulin will cover a specific amount of carbohydrate grams (e.g. 1 unit of Humalog will cover 15g carbohydrate (1u = 15g))

• If your carbohydrate counting accuracy is “off” your insulin dose will be too

• When set correctly the BG should not rise more than 40-80 mg/dL (2.2 - 4.4 mmol/L) 2 hours after the meal

• Adjust the ratio by 1 to 2 grams at a time
Disclaimer ...

• Carbohydrate counting is an art, NOT a science.

• It’s “carbohydrate guessing”

• Most people tend to be 25-30% off when they “guesstimate” carbs

• The food label can be 20% off
Put Carb Counting into Practice

What is the carbohydrate, fat, protein and caloric content of the following meal?

- Small hamburger
- Small french fries
- Diet coke
Meal Example: Carbohydrates

What is the carbohydrate content?

60 grams or 4 carb exchanges (4kcal/g x 60g = 240 calories)

Small hamburger = 31g or 2 exchanges
Small french fries = 29g or 2 exchanges
Diet coke = 0g
Based on the Rule of 500, a total daily insulin dose of 50 units would result in an insulin-to-carbohydrate ratio of:

A) 1:5
B) 1:8
C) 1:10
D) 1:18
Rule of 500
– use to determine I:C ratio

• 500 divided by Total Daily Dose (TDD) of insulin
• 500 / 77u = 6.4g → 1u for every 6g eaten (insulin to carb ratio)
• 60g / 6g = 10u for the meal example
Meal Example: Fat

What is the fat content?

20g (9kcal/g x 20g = 180kcal)

Small hamburger = 9g
Small french fries = 11g
Diet coke = 0g
Meal Example: Protein

What is the protein content?

12g (4kcal/g x 12g = 48kcal)

Small hamburger = 12g
Small french fries = 0g
Diet coke = 0g
Meal Example: Calories
What is the caloric content of the meal?

468 Calories
Polling Question

How many kcal of fat/protein is equivalent to 1 fat/protein unit?

A) 50
B) 75
C) 100
D) 125
The Warsaw School Procedure for Calculating Mealtime Insulin Dose: Overview

Carb content delivered as normal bolus based on I:C ratio

100 kcal of fat/protein = 1 fat/protein unit (FPU)
1 g protein = 4 kcal (25 g protein = 100 calories)
1 g fat = 9 kcal (11 g of fat = 100 calories)

If using a pump: Delivered as combo/extended bolus

1 FPU is extended over 3 hours
2 FPU extended over 4 hours
3 FPU extended over 5 hours
>4 FPU extended over 8 hours

Johnson & Johnson INSTITUTE
The Warsaw School Procedure for Calculating Mealtime Insulin Dose: Carbohydrate

Carb content delivered as normal bolus based on I:C ratio

**Example**

I:C ratio = 10g
60 grams of carb from meal example
6 units of insulin given as a normal bolus

60g divided by 10g per unit of rapid acting insulin = 6 units for carb coverage
The Warsaw School Procedure for Calculating Mealtime Insulin Dose: Protein

100 kcal of fat/protein = 1 FPU

1 g protein = 4 kcal = 25 g protein = 100 calories

1 ounce of protein (size of domino) meat, fish, pork, chicken, cheese = 7 g protein

3 ounces (size of deck of cards) of meat, fish, pork, chicken, cheese

3 whole eggs

12 g protein in meal example = about half a FPU
The Warsaw School Procedure for Calculating Mealtime Insulin Dose: Fat

100 kcal of fat/protein = 1 FPU

1 g fat = 9 kcal (11 g of fat = 100 calories)

2 TBSP peanut butter
20 peanuts
12 cashews or almonds
2 tsp butter, mayonnaise, oil, salad dressing, cream cheese
2 slices of bacon
4 TBSP half and half

20 g of fat in meal example = almost 2 FPU
The Warsaw School Procedure for Calculating Mealtime Insulin Dose: Putting it Together

100kcal of fat/protein = 1 FPU

Meal Example:
60g CHO = 6 units as normal bolus
12g PRO x 4kcal = 48kcal = .5 FPU
20g FAT x 9kcal = 180kcal = 1.8 FPU

Recommend approximately 2 FPU

If using a pump: Delivered as combo/extended bolus
1 FPU is extended over 3 hours
2 FPU extended over 4 hours
3 FPU extended over 5 hours
>4 FPU extended over 8 hours
Carbohydrate Counting: Other Factors to Consider
Polling Question

The American Diabetes Association and the Canadian Diabetes Association differ in their recommendations regarding carbohydrate counting and fiber.

A) True
B) False
Fiber

Food Sources:
Whole wheat bread, crackers, tortillas, pasta, brown rice, beans, lentils, oatmeal, fruit, vegetables

Canadian Diabetes Association:
Fiber does NOT raise blood glucose and therefore should be subtracted from the total carbohydrate

American Diabetes Association:
Only half of the fiber grams should be subtracted once you get over 5g
Sugar Alcohols
Names: SORBITOL, XYLITOL, MANNITOL, ISOMALT

• “ol” ending

• not completely absorbed in the body and have less of an affect on blood sugar

• Large amounts = laxative affect

• If a food item contains 5g of sugar alcohol or more, subtract half of those grams from the total carbohydrate

(ADA Nutritional Guidelines 2013)
A carb, is a carb is a carb ... right?
Glycemic Index (GI)

- Ranks carbohydrate containing foods by how much they raise blood sugar levels compared to a standard food.
- The standard food is white bread or glucose which is given a rating/number of 100.
- Foods are given a rating/number between 1-100.
- The higher the rating/number the higher the potential rise in blood glucose.
- Goal = select foods with a GI of less than 70.
Glycemic Index (GI)

Medium GI Foods
(rating of 56-69)

• Whole wheat, rye and pita bread
• Grapenuts, oatmeal and puffed wheat cereal
• Basmati rice, potatoes, corn, popcorn

Low GI Foods
(rating of 55 or less)

• 100% stone ground whole wheat & rye bread
• All-Bran cereal
• Barley, pasta, sweet potatoes
• Legumes
Resources

- Calorie King Calorie, Fat and Carbohydrate Counter, CalorieKing Wellness Solutions – book
- www.calorieking.com
- App examples: Figwee, My Fitness Tracker, CalorieKing
Remember ...
Art … NOT Science

• Encourage patients to “be your own science experiment”

• Check before and 2 hours after the first bite of eating

• Pre-meal target 90-130 mg/dL (5.0-7.2 mmol/L)

• 2 hour post-meal target 180 mg/dL (10 mmol/L)

• Adjust portions and try again
For more information visit www.jjdi.com. **Become a member and opt in** to be notified about our new programs, publications and more!

**Follow us on Twitter @JJDiabetesInst** to receive timely and important updates about diabetes!